Energy-Water Nexus Workshop
West Region Workshop
Breakout Group D
Facilitator: Scott Hasse
Notetaker: Wayne Einfeld

Breakout No 1 Energy Supply

Present:

Gary Collins – Indigenous Waters Network
Larry Dale – LBNL
Robert Goldstein – EPRI
Ray Ehrhard – Washington University, St. Louis
David Susong – USGS
Douglas Arent – NREL
Susan Kelly – Utton Center
Paul Wichlacz – INL
William Hammetter – SNL
Clarence Prestwick – NRCS
Scott Flake – Sacramento Municipal Utility
Cheryl McGovern – U.S. – EPA
Carly Burton – Pacific Corp.
Nolan Clark – ARS – USDA
Kevin Cooney – Summit Blue Consulting

Roundtable introductions
Start with Energy problems issues
Use matrix as guideline to steer discussion

Are we discussing electricity production or energy supply? Answer: The focus is on production in this session

We have a combined-cycle power plant in Sacramento. Have access to and ownership of water rights for power production. There was a big effort to license and use these existing water rights. The utility was urged to use dry cooling. There are serious economic constraints and efficiency losses associated with dry cooling, which were important considerations. The problem is the ability to use water rights already in possession of the utility. Air quality is an important consideration not being considered in this workshop. It is a big limiting factor in development/re-licensing of power plants.

Federal and state agencies have much overlapping regulatory authority. Many 50 year licenses are running out on old power plants in California and require a lengthy re-licensing process. There is a lot of new plant activity. Hydro facilities are running out. California is facing a decrease in energy production in spite of projected increases in demand. A lack of good understanding of environmental impacts tends to result in

extreme solutions; environmental research on effects of hydro production should provide a baseline for decision-making and planning. You can't necessarily apply other river basin experiences on environmental impacts to other basins. One approach doesn't fit all watersheds.

In order to make renewables viable, there is a storage problem. There are some promising renewables – wind, solar. Pump storage problems need to be addressed: electricity is being used to create electricity. Need more emphasis on reuse of water, e.g. use it over and over again.

The emphasis should be on alternative sources or storage for peak demands. Peak demand is a big issue in CA. Differentiate between energy production and capacity.

Short term storage of electrical energy and running systems "closer to the edge" of power demand with needed storage to cover peaks. Problem is how to do this and manage short term storage, dispatch and management of this energy. Research is needed on intermittency issues that are associated with renewables

The problem is an infrastructure design issue - how to design renewable systems to mesh with the conventional grid.

Optimizing location of power sources within a grid system in hopes of overall increased efficiency—what tools are available?

From the hydro perspective, the FERC process is problematic. It takes 3 years to license plants. Licensing costs $30M, and it is reluctantly done--only because it is cheaper than decommissioning the plants. It takes a 10 year lead time to build coal fired plants. There are two peak seasons-winter in NW and summer in the mountain west. All is driven by population growth. PacifiCorp. built two combined-cycle turbine plants-why such a long lead time? Air quality/permitting issues. Another issue: 525 MW dry cooling project requires 400 acre-ft of water compared to 500 MW wet cooling plant with 7,000 ac-ft consumption.

It is difficult to access water from ag sources for water cooling. Getting water from ag sector is a big problem—how to get the water and still maintain ag? Buy low producing farms—contingent markets are being used in UT. "All the easy water is gone"

Ag is no longer sacrosanct—the water market will eventually work and ag will sell rights at the right price

impacts on AQ are based on fuel needed

Clarification question on pump storage. Answer: hydro facility pushes the water back up the hill with low cost energy (nighttime), re-route when needed for peak. Will be a net loss but the value of energy changes with time so it works economically overall.

Renewable clarification—pump storage technologies have evolved over time/now trying to apply regulations that are not applicable to these new technologies. Problem: regulations need to be consistent and updated with the new renewable technologies. CA will soon have ~20% of energy provided by renewables, so the impetus to do this is here.

Total cost must be considered in building power plants – environmental costs, water costs. CA Ocean Action Plan (get reference). Fish stocks are dropping (60% since 1970s)—is this due to the presence of 21 coastal power plants using seawater cooling? What are the impacts of coastal power plants in ecological terms?—this is a research gap. How do you quantify total cost of technology options—are all factors included such as environmental factors? Integrated analysis tools are needed. Economic analysis and planning tools are needed. Emphasis on non-traditional economic analyses.

Need for research on environmental impacts on "impingement and entrainment" water intake and fish kills. What alternatives are available?

Pumped storage—how will it influence WQ? Need to coordinate how a renewable project can have a dual positive impact. Get a net benefit from the water sources along with peak power.

There are broad impacts of scarce water sources. E.g., El Paso Utilities is shutting down a coal plant in Arizona. Shutting down the coal plant shifts demand elsewhere-what are the water rights for that system? Are the costs of shutdown greater than the benefits gained? The cost of water is increasing more than the value of coal. The Navajo Nation is unwilling to discuss uranium extraction on Indian land due to many unresolved social issues and public health concerns. There is a high mortality rate. There is a need to address the broader socioeconomic issues in Indian country prior to implementation of power projects. Governmental oversight is not as strong as it should be in these deliberations. Better to deal with issues early, not at 11th hour. Need to recognize Indian resources with appropriate planning so they can be used vs not being used at all. We need to understand the trust responsibilities to the tribes. Tribal sovereignty. The Southern Ute agreement is an example of how to approach tribal issues. There are tribal water codes that provide good examples for resource management.

CA importing power is much like importing water. Problem: inter-basin transfer of water associated with power production is not considered. Implied water transfer with imported electricity should be considered. Rebuttal: Do we have to do this for everything? E.g., Importation of Ag products implies consumption of water resources as well.

Long term problem—we have large power plants in central locations—centralized power configuration. Turn it around and look at distributed power units—small enough to carry in your pocket/subdivision/household. Many infrastructure elements could be done away with or at least wouldn't need further expansion, e.g., power lines. This should be a priority research area and is a problem in rural America: Rural farmers can't access electricity for pumping etc. Can't increase electricity use since power capacity on

transmission system is at maximum use now. Power line construction is a big cost and issue. Attendant problem is management of a distributed network. Could localized systems be smart enough to be integrated with the overall system?

Low-S, low-ash coal gone in southern UT. Resource is running out in certain areas. What is long term implication in terms of AQ and water consumption?

Hydrogen technologies—where does this fit in matrix? EPA's state implementation plans give credit for renewable energy use but can't do that since renewable use from a distributed network can't be tracked to a localized source—thus a lack of renewable use incentives for a locality such as Sacramento. This is likely a policy problem. How to promote incentives for efficient power production that lessen AQ impacts? Fresno was cited as an example. Fresno has an AQ problem. Energy is coming from Utah. EPA can't give AQ credits. If Fresno reduces usage, EPA can't provide incentives.

With regard to hydrogen, it was noted that we are also running out of natural gas.

Other water issues associated with extraction?

WY issue: high natural gas prices have resulted in lots of new gas and also produced water. Rangeland irrigation/high salt content/alkali crust results from evaporation—environmental effects. MT is developing new standards—WY impaired water can't flow into MT. This will hinder coal bed methane resource in intermountain west. Hobbs School at UofWY published a report. (get ref)

Tribal standards were discussed – Pueblo of Isleta v. City of Albuquerque.

What is potential use of impaired (produced) water?

Problem: Produced water management—disposal of produced water—initial high production rate of water relative to gas. Two ways of disposal—deep injection (San Juan Basin) and surface treatment, e.g., evaporation or land application. (get ref)

Fresh water is often used for gas well extraction—often used in early stages prior to availability of produced water.

Water rights: In some states, water rights may be needed for produced water. It varies from state to state.

Endangered Species Act: fresh water sources needed to maintain surface water flow for endangered species could be a constraint for fresh water use.

NEPA: There needs to be an approach of how to deal with water for energy development/lots of federal land in west—NEPA usually kicks in.

Long term hydrological impacts of produced water management—what happens when you dewater a coal bed?…also what happens to reinjected water? What are the cumulative long term impacts of produced water production?

Larger issue of improved energy efficiency—to reduce demand and power sector growth. Problem: lack of effective pricing to promote efficient use. Flat pricing has no economic incentives. (same holds true for water) it is a pricing issue as well as a conservation education issue.

What about oil shale development? It needs a lot of water for extraction and processing. Problem: how to reduce water consumption /reduce degradation of WQ.

Fuel production and energy sources. Ethanol production requires a lot of water to grow the crops. Increased ethanol production will be a problem for the western US. Methane production from animal waste—also requires water for slurry production, etc. Biodiesel is a better alternative—less water use—short term issues. Also applies to hydrogen production.

How much water is used to produce solar PV cells? BP has the numbers (get reference from Brown). Emphasis on systems-view tools that can help inform options and choices. Is there a problem of implementation of these tools?

E-bill addresses some of the issues—right of way, eminent domain issues. We should examine how the ideas raised in this workshop interface with the E-bill.

New coal technologies—are they less water intensive? Alternatives to coal slurry transport technologies. Coal mine drainage is an extraction issue. Better understanding of clean coal technologies—coal gasification included.

Coal slurry pipeline concept should be further investigated.

Idea of coal slurry pipeline from WY to TX stopped by railroad issues 20 years ago. Train/track resources appear to be the limitation. Power lines, rail lines etc. from WY to the rest of the nation. Can the resource benefits be kept more localized? …Should all western basin (e.g. WY) resources be shipped to the east? Getting onto the grid is a big problem. (This is related to the centralized approach vs distributed approach problem stated previously.)

There is an inability to ship power east and west—across reliability grids. Infrastructure problem—few connection points from east to west. (Can go north/south.) Rebuttal: This is done for power reliability security reasons—to avoid national blackouts.

Participant noted that water is also needed for transportation infrastructure —barges, etc. to move coal.

Costs for renewables are high. Not economically viable…location determines costs. Problem with production occurring during non-peak hours. How can we better understand the total cost of renewables.

Renewable (e.g. wind) is produced at non-peak periods and takes up line capacity—it is difficult to assess overall benefits. SMUD focuses on renewables. Wind energy is non-dispatchable. We need capacity-building technologies.

Problem is timing; lack of storage.

Rural power infrastructure—many of transmission lines are single phase…how can farmers pump water with 100 hp motors on this grid? Likely that grid will not be upgraded—more likely to see distributed power systems come into play. This points back to power management issues associated with distributed power systems. Solution may be micro-grid. Same applies to water distribution infrastructure.

Regulatory problems with local power sharing: a farmer must generate at one location, sell to a utility and buy it back down-line, based on current regulatory structure.

Economics of renewables can be calculated.

Break at 12:25

Post-lunch discussion:

Need is to guarantee a reliable water supply for new power plants during drought periods.

CEC doesn't regulate water… no authority or mechanism to regulate and control. The power problems beyond the municipalities in CA are falling between the cracks.

Extraction issue is high cost of produced water treatment.

Hydropower vs water supply in reservoirs--tradeoffs are not being discussed. A storage or supply/allocation issue. Ag users may switch to water efficient systems, e.g., pressurized drip, but higher energy costs can result, e.g., pressure pumping costs. Water conservation must be considered along with energy consumption in assessing alternative strategies. "It's all interrelated." Water conservation and energy use need to be more strongly linked.

Combine issues and clarify?

Panel voting—three dots each

Voting results

Primary three energy supply issues:

1) Infrastructure issues

2) Power dispatch optimization

3) Lack of integrated planning tools for resource analysis/allocation

See flip charts for voting results

Results also summarized in Problem summary ppt used for Day 1 summary session

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Breakout No 2 Water Supply

15 present

Lack of long term regional planning to deal with drought cycles. CO River allocation as example.

Reuse of effluent streams is controversial. What are health risks associated with reuse? Power companies have been blocked from using reuse water in cooling cycles. Establish health risks through research.

Can't necessarily use waste water…must be returned to stream for ecological reasons…highly site specific.

Arizona wants to avoid an effluent discharge permit to the river so they are injecting waste water instead.

Very scale dependant…two basic questions: Is the water available? And of desired quality? Problem: basic resource scarcity—requires prioritization of use. How to market? Who has rights? Problem intensified for desired water with higher quality. Match water quality to water use.

Need data gathering or policy. Water rights are a mess. Who owns what? CA Water Resource Control Board queries users and gets little data in return. Reluctant to divulge water use…state water board doesn't know rights and whether consumption data is reliable. Problem: quantification of water rights. You may have a water right but there may not be water associated with that right…adjudication can be protracted and complicated.

CA 30-40% of water is pumped…most not adjudicated. There are no limits to pumping. Ground water (GW) levels are dropping…farmers face increased pumping costs. Problem: Understanding and modeling GW. Problem: understanding drought impacts…GW pumping is not tied to potential drought conditions.

Other states have provisions to restrict GW rights (junior users) based on GW availability and whether junior pumpers are impairing senior water rights. (Utah and Idaho cited as examples.)

Very complicated to understand water rights. Lawyers and judges are left to figure it out…how best unscramble the mess? Contracts and rights need to be respected. Need to understand climate change relative to hydro production.

Competing interests need to be balanced…there is no national guidance on how to allocate priorities. Electricity or trout? Many decisions are poorly managed or mis-managed…affects E production by ten percent. FERC process operates independently of other federal agencies. USDA and Interior are all players in the regulatory mix. CA also has state regulatory oversight—mandatory conditioning authority. Many contrary ideas in management choices. The problem trend is increasing based on limited resources

The trend for all problems discussed so far is increasing…with exception of health risk understanding which is flat.

Modeling is an issue in water management. Big Horn case in WY: 27 years in courts and water rights are still not decided. The case hasn't created any more water and hasn't created certainty. Decisions should be made by those who are well informed. Quantification is difficult…don't want to assign numbers. 28 tribes with interests in water (in WY?). The dams were built on reservations for political expediency. A model of a drainage system or water shed under various scenarios is needed to assist planning and management.

Udall foundation involved with dispute resolution. Models would help alleviate disputes.

Data inputs are needed to run the models. Ability to measure surface water is degrading. USGS river flow monitoring funding is dropping: 8000 to 7000 gauging stations and trend is going down. USGS no longer estimates water consumption; only does withdrawal. All of the above impact the availability to do watershed modeling.

Section 106 (state grants) of CWA stipulates funding amounts for water quality…more pressure to monitor on states. Less discretionary use of federal (EPA titlement) funds by the states.

Bay-Delta area -- Decreasing smelt population---wild salmon all need fresh water. This is a competing use…ecological interest fisheries. 2/3 of water in CA is generated in the north and 2/3 of water in CA is used in the south.

Impervious surfaces in urban setting impacts GW recharge.

Lack of water storage capacity…build more dams (ha ha).

Other (non-dam) storage options exist---research into intelligent storage (off-stream diversion and storage)

Source water protection plans…do the plans incorporate all the intended uses? Develop tools to enable better source water protection. E.g., are the EPA's emerging contaminants included in a source water protection plan?

Water rights issues. Good technologies will die because the water cannot be moved. Moving water across state lines and reservations involves many issues that need understanding and resolution…what are the obstacles to doing this? (We can't solve this, but this project can look at what the issues are for water transfers and what it takes to facilitate.) How can the feds facilitate interstate/reservation water transfers. The stakeholders in this process should be identified.

Disconnect between technology and political/judicial process. Try to provide technology in package such that policy folks can make wise decisions. Ultimate use is decided in courts. "Water flows toward money…whiskey is for drinking and water is for fighting." Too many non-coordinated groups have a piece of the allocation authority. No federal agency has ultimate decision authority for water quantity and water quality. Too many involved but no one agency with decision authority.

Measurements of the water source are lacking in both quality and quantity. In many cases the owner doesn't want to know—fear of litigation. Also there are no incentives for conservation…("use it or lose it" doctrine). More efficient use results in reduced allocation. Only incentive is energy savings for no pumping.

Technology from labs to better measure water resources, e.g., remote sensing of snow pack and water use by agriculture, would help.

There is a lack of segmentation based on needed quality for intended use. Dual water infrastructure doesn't exist since water is not valued. Problem: low value placed on water. Same applies to treatment…presently, one size fits all in terms of treatment. What about collection of water…high tech cisterns…point of collection use. Green building design is just starting. Not mainstream yet…yet the economics work. Institutional barriers exist for this type of reuse, e.g., unresolved public health issues and state law which requires run-off be returned to the surface water supply.

Utilities typically have 15% loss in distribution system—pipe leakage. Efficiency problem—little incentive to find and fix. Problem: degraded infrastructure.

Can better technology be developed to assist in leak detection and predicting infrastructure failure? Answer: Some utilities are using distribution-wide software to identify regional areas of leaks in order to help pinpoint the leakage area.

We need to figure out how to incentivize people to give up rights in the interest of less consumption. This is difficult because our system of beneficial use is rooted in basic constitutional/legal issues.

Experience is that decision support modeling results that have been used in decision-maker group settings can often be disregarded in the interest of overriding political interests.

Our planning horizons are far too short.

What's happening in west? Answer: conversion from Ag to muni and industrial. Where is this going to end? Problems will increase as the number of active farmers are reduced. On positive note…muni usage is lower than ag…on the other hand muni is a fixed demand whereas Ag demand can be varied, e.g. when supply is short.

Problem: waste water utilization is not where it could be. There is a need to get away from uniform treatment, to treatment choices based on intended reuse. Laguna Liguel has an innovative system of giving credit for conserving water/using recycled water.

Think of the larger system…e.g., fixing leaks in water conveyance channels can reduce GW recharge. Some communities depend on this leakage for their water supply!

In recreational space/usage there is reluctance toward efficiency. E.g., cemetery, golf courses, parks. Is adequate technical help provided to these groups for the design of water-efficient systems?

SRFund loans to encourage reuse. Congress just cut SRF allocations significantly

Predominate household use is for lawn irrigation. Can this be considered a "drought reserve" or is it simply water waste?

Need paradigm shift in thinking about water. Educational component is missing…e.g. Bellagio in LV -- impressive until you drive over to see Lake Mead. In AZ, increased pop and reduced water, AZ universities are developing educational components.

GW recharge is affected by impermeable surfaces…smart development is the answer.

Interconnect often neglected between surface (river) water and GW aquifers

UT program "Slow the flow--save H20" targeted to reduce consumptive use 25% by 2050. Water use has dropped by 15% already. How can we maintain conservation practices in wet years? Long term educational challenges.

Yukon river…goal is drinkable water in 50 years. Even in AK water quantity/quality is at issue.

Incentivizing people…utility pricing approaches…winter water rate baseline, with increasing costs in summer.

Urban water…green roofs (to capture run-off?) dual benefit…white roofs lower energy load as well as evap cooling benefits…also solar cells on roofs.

Technologies to reduce consumptive use in agriculture while still maintaining agriculture are needed.

Agrimet systems…precision ag technologies. BoR developed climate system for farmer use for irrigation planning purposes. ET models are also in use in TX area…faxes and internet distribution. 1.5 million acres save 2 inches a year…programs all over western regions.

Efforts underway to tweak ET crop coefficient values to be more crop specific. Needs more money for development.

DOE and NRCS could develop BMPs for energy water efficiency in agriculture.

Voting Results

6 top issues (consolidation as follows):

1) Lack of data and integrated models
    - Drought impacts
    - Ground water resources
    - Surface water resources
    - Integrated with energy use

2) Match water quality, use and treatment

3) Balancing competing water uses
    - Electricity production/recreational uses/ag/ecological etc.
    - No metrics/value attribution approaches are needed
    - Decision support tools required
    - Absence of overarching policy/guidance

See additional info on flip charts and Problem summary ppt

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Breakout No 3 Needs Discussion

13 in attendance

Energy Problems 1 and 2 – Optimize integration of various generation technologies and outdated infrastructure

- Better power storage technologies
- Adequate DOE/Congressional funding for renewables, other research
- DOE cooperation with utilities is necessary—disconnect between DOE and utilities, more data sharing needed without necessarily making information public.
- Additional work in technologies for efficiency and conservation across the entire spectrum (in both energy and water sectors and at all scales—the tap in the house to the power grid).
- Optimize use of off-peak energy, e.g., electric vehicle recharge. Expand energy storage opportunities
- Need for commercialization pathways of new technologies, particularly in renewables; also dissemination of research results to industry
- Need for better technologies and industry partnerships that will avoid the existing order backlog of wind turbines and solar materials (PVs). Presently the demand is higher than manufacturing capacity.
- Need for consistent national policy related to renewables, e.g., production tax credit. Changes in national policy promote renewables, then subsequently take away the incentives. Presently the demand is based on state policies which are highly variable.
- Wind and solar are driven by tax credits which are highly variable. Uniform and consistent national policy needed. CA Title 24 (energy efficient building codes) spread across the country would be a good thing. Germany has a consistent national policy on solar.
- How do you integrate all these non-dispatchable power sources into the grid? Many of these are steady state whereas power demand can ramp up quickly. Wind and solar are non-dispatchable. Storage on super conductors…control technologies…how do you get the grid to respond more quickly to power demands from these non-dispatchable power sources? Pricing structure may also be needed here, e.g., what is the value of electrical power from residential feeds into the grid at peak demand intervals. Off peak incentives are needed.
- Need more large demonstration projects that are teamed with industry partners, e.g., central solar-molten salt storage. Also, control technologies for dispatch of power into the grid.

- Who is controlling what with respect to the grid? In CA deregulation resulted in no central responsibility for the grid. Sacramento utility (SMUD) broke away and others are joining their grid. So SMUD essentially controls the grid supplying most of CA. The traditional power grid is becoming highly fragmented. This will result in more and more blackouts. FERC is supposed to be working on this.
- DOE should do collaborative research with EU countries that are much more advanced in the area of renewables and their incorporation into the power grid.
- USDA has a database of ag production. ERS can do research with the data without making it public. Can this concept be applied to energy and water while respecting proprietary issues? Could DOE set up procedures to encourage utilities to submit data into this data bank for researcher use? Data consistency among utilities is not very good. CEC has data but won't share it with labs due to confidentiality issues. Similar problem with water data, although there are federal and local quality reporting requirements. Drivers for power utility confidentiality concerns are related to fears of increased regulation, homeland security issues, industry competition and privacy issues.
- CARB 2007 air quality (AQ) standards are very strict for NOx. Diesel generators don't meet these. Can't build any more peaking plants based on AQ issues. Need peak shifting technologies.
- Outdated infrastructure issue. Decentralized system requires management models. EPA did this with decentralized waste water treatment. Develop and demonstrate management models for a decentralized, distributed energy system. Could be done for electric, water and wastewater.
- Research on solar to reduce material costs, e.g., relative high cost of PV cells. Is there a way the DOE could support private industry in renewable energy technology development?
- A stable and predictable national energy policy might promote US-based manufacturing capabilities.
- Revised pricing policy to reflect the true price of power and water.
- Develop hydropower on existing reservoirs that don't have existing hydropower capability.
- Supplement existing hydro plants for additional capacity
- Need LNG terminals to bring additional supply into the country. A lack of policy with respect to LNG importation. Currently terminals are in Mexico and LNG is shipped to CA.
- Need new material/technology for transmission lines—to increase the power capacity

Energy Problem 3: Lack of integrated planning

- Develop models/tools for integrated planning. Tools should integrate water, energy, air quality issues. E.g., Delaware River Basin Commission is a good example of water resource planning, but power demand may not be fully integrated.
- Should DOE re-examine the role of FERC and revamp as necessary? Is a legal analysis required to assess where gaps exist?
- Can the FERC process be streamlined for re-licensing? This process amounts to a huge cost for utilities.
- Can tools be developed to analyze water resource options for a planned power plant? Water supply/demand modeling tools are needed in the plant planning stages.
- Cost-benefit analysis should be implemented at a larger scale—to include non-traditional costs and benefits. Need to incorporate environmental issues. E.g., develop accounting spreadsheets that reflect "non-economic environmental externalities." Response: Hydro re-licensing does include a consideration of socioeconomic factors.
- Revisit power plant licensing—need one stop shop. Now it is accomplished in the court system. Develop a roadmap process for the power plant licensing problem that includes case studies and incorporates disparate regs, policies, authorities etc. Similar problems exist for other resource areas.
- PacificCorp is evolving into smaller units with less impact on resources. Wind turbines/solar have no impact on water.
- [Reference: iaus.com]
- 30% tax benefit in new energy bill for wind/solar. (check this)

Water Problems

- Research that evaluates impacts of pricing policies with regard to both water and energy. Consumer response to various pricing policies that integrates both water and energy.
- Could DOE develop a technology verification process for new power and water that would promote acceptance and use of new technologies? A certification process could be developed similar to ETV or NSF for new technologies. Similar to "Green E" for renewables. Could be public or privately run.
- Could a contest (similar to refrigerator contest sponsored by DOE) be sponsored by DOE to promote market transformation of the renewable sector.
- Lack of data: Best management practices guidance for both energy and water projects. This is related to the problem of competing uses of water.
- Lack of data/models: Improved understanding/models to better understand drought. Better definition of drought and ability to forecast for worst-case conditions.
- Planning models: Need for DOE-sponsored models that take climate change into account in water resource assessment, particularly for hydro plant planning, development and operation.
- Need a national policy on climate change.
- Lack of Dual Use: Research on infrastructure technologies to move toward dual-use water systems. Data collection and case studies are needed to better understand dynamics of reuse systems. Should cost-benefit analysis be carried out on reuse systems to further promote their use? Need research on retrofit technology.
- Should a lifecycle analysis of water be carried out that takes energy consumption into account? This would probably need to be case-by-case.
- Research needed on moving from copper to carbon transmission lines.
- 20% of CA energy consumption is associated with water (mostly pumping costs)

Consolidation of the above into the following categories

Modeling

Data Sharing and Case Studies

Technology RD&D

Pricing, Economics and Valuation

New Sources of Power

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Breakout No 4 Solutions Discussion

10 in attendance

Technology Solutions

- Water Star – EPA Energy Star program that would be applied to water. Lead agency could be EPA. Applicable areas household appliances, water intensive industries (e.g. golf courses, water treatment plants, etc.) Commercial, industrial, residential users.
- Efficient air conditioner contest for industry
- Radically change the water pricing structure.
- Totally replace all steam generating technology. Search for technologies that don't use the steam cycle.
- Replace conventional coal-fired power plants with coal-fired, combined cycle power plants. This would require some sort of coal gasification technology.
- Plant genetics and breeding for low-water use with low (e.g. high-salinity) quality water.
- Advanced materials to improve power transmission line capacity.
- Research into non-silicon based PV cells.
- Conservation reserve program for ag water. Pay farmers not to use water. Market-based water banking. Administered by USDA and local water districts.
- More aggressive public education program targeted at conservation issues.
- Advanced storage technologies (flywheels, advanced superconducting batteries, compressed air, ice)
- Design the next-generation nuclear power plant with water conservation in mind. Consideration should be given to helium-cooled plants. Toshiba has 10MW nuclear modules, no water use, much like very large thermo-electric batteries. Well-suited for distributed power systems. Is this a technology for the future? (Side comment regarding the need for re-opening the debate on domestic nuclear fuel reprocessing)
- Investigate wave energy.
- Certification program for best management practices for new technologies
- Development of remote sensing technologies for water resource assessments. Crop type, E-T measurements, snow pack, river stage, etc. To be used for resource estimation and forecasting.
- Development of integrated modeling tools that include air, water, energy for power demand forecasting.
- Develop models to help with power integration and power management of the distributed power grid.

- Improved technologies for distribution-side water leak detection.
- Alternatives to conventional transportation modes in the US.
- Improve the supply chains of preferred fuels, e.g. natural gas.
- Develop and deploy modular power systems for small towns and/or larger farms—based on wind, fuel cells, methanol, biodiesel technologies as appropriate to the region. 20,000 potential deployment sites in North America. This would avoid upgrades to current distribution systems.
- Develop data bank for data collection, sharing and analysis.

Voting on the above…

For voting results see summary Needs/Solutions ppt file

Additional Policy needs:

- Highlight regulatory layers
- Develop decision trees for various projects
- Compile all regulations and organize
- Present case studies
- Compare energy bill to roadmap initiatives
- Examine how policy can support the technologies
- How can technology support policies?